

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: July 23, 2019

TO: Holly Heldstab – WCR

FROM: Wade Strickland – WY/3

Diane Fried for WCR

SUBJECT: Water Quality-Based Effluent Limitations for the Baldwin Wastewater Treatment Facility
WPDES Permit No. WI-0026091

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using Chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Baldwin Wastewater Treatment Facility in St. Croix County. This municipal wastewater treatment facility (WWTF) discharges to the Baldwin Creek, a tributary to the Rush River, located in the Rush River Watershed in the Lower Chippewa River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
BOD ₅	30 mg/L			15 mg/L		1
TSS	30 mg/L			20 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1
Ammonia Nitrogen						
October			16 mg/L	10 mg/L		2
November – April	16 mg/L		16 mg/L	10 mg/L		
May – September			5.6 mg/L	2.2 mg/L		
Fecal Coliform			780#/100 mL	400#/100 mL		2
May – September			geometric mean	geometric mean		
Phosphorus						
Interim				4.7 mg/L		
Final				0.225 mg/L	0.075 mg/L	
Nitrite + Nitrate						1,3
Total Kjeldahl Nitrogen						1,3
Total Organic Nitrogen						1,3,4
Chloride						1,3
Total Dissolved Solids						1,3
Temperature						1,5

Footnotes:

1. No changes from the current permit
2. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) are included in bold.
3. Monitoring only

4. Calculated value
5. Temperature monitoring during the 4th year of the permit term

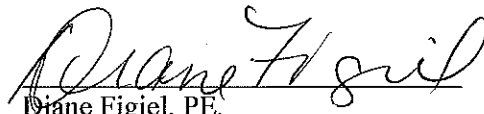
No WET testing is required based on Chapter 1.11 of the WET Guidance (WET Testing of Minor Municipal Discharges). This is a minor municipal (< 1.0 MGD) discharge comprised solely of domestic wastewater, with no WET failures and no toxic compounds detected at levels of concern. Because there is a very low risk of toxicity, no WET testing is recommended.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Benjamin Hartenbower at (715) 839-3712 or Benjamin.Hartenbower@wisconsin.gov or Diane Figiel at (608) 264-6274 or Diane.Figiel@wisconsin.gov.

Attachments (4) – Narrative, Ammonia Limits, Thermal Table, & Map

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Date: 7/23/19

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Water Quality-Based Effluent Limitations for Baldwin Wastewater Treatment Facility

WPDES Permit No. WI-0026891

Prepared by: Benjamin P. Hartenbower

PART 1 – BACKGROUND INFORMATION

Facility Description:

The Baldwin Wastewater Treatment Facility treats domestic wastewater from the Village of Baldwin and industrial categorical wastewater from Donaldson Company Inc (metal finishing). The annual average design flow of the current facility is 0.292 million gallons per day (MGD) and the actual annual average flow in 2018 was 0.425 MGD. The treatment facility consists of an influent fine screen, grit removal, oxidation ditch, final clarifiers, ultraviolet disinfection and post aeration. Solids handling includes aerated sludge storage as well as a gravity belt thickener.

Attachment #4 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations: The current permit, expiring on September 30, 2019, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
BOD ₅	30 mg/L			15 mg/L		1
TSS	30 mg/L			20 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1
Ammonia Nitrogen						
October				10 mg/L		
November – April	34 mg/L		26 mg/L	10 mg/L		
May – September			5.6 mg/L	2.2 mg/L		
Fecal Coliform				400#/100 mL		
May – September				geometric mean		
Phosphorus						2
Interim				6.2 mg/L		
Final				0.225 mg/L	0.075 mg/L	
Nitrite + Nitrate						1,3
Total Kjeldahl Nitrogen						1,3
Total Organic Nitrogen						1,3,4
Chloride						3
Total Dissolved Solids						1,3
Temperature						5

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. This is an interim limit. The final WQBEL is 0.075 mg/L as six-month average and 0.225 mg/L as a monthly average. A compliance schedule is in the current permit to meet the final WQBEL by December 1, 2023.
3. Monitoring only
4. Calculated value
5. Monitoring during 2017

Receiving Water Information:

- Name: Baldwin Creek
- Classification: Limited Forage Fish Community, non-public water supply.
- Low Flow:
 - 7-Q₁₀ = 0 cfs (cubic feet per second)
 - 7-Q₂ = 0 cfs
 - Harmonic Mean Flow = 0 cfs
- Hardness = 217 mg/L as CaCO₃. This value represents the geometric mean of effluent data submitted with the permit application. Effluent hardness is used in place of receiving water because there is no receiving water flow upstream of the discharge.
- % of low flow used to calculate limits: 25%
- Source of background concentration data: Background concentrations are not included because they don't impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: None
- Impaired water status: No Impairment

Effluent Information:

- Design Flow Rate(s):
 - Annual average = 0.292 MGD (Million Gallons per Day)
 - For reference, the actual average flow from December 2014 to April 2019 was 0.40 MGD.
- Hardness = 217 mg/L as CaCO₃. This value represents the geometric mean of effluent data submitted with the permit application.
- Acute dilution factor used: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Domestic wastewater with water supply from wells
- Additives: Aluminum sulfate
- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, primarily metal substances plus Hardness. The permit-required monitoring for Ammonia, Phosphorus, and Chloride from December 2014 to April 2019 is used in this evaluation.

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled "MEAN EFFL. CONC.".

Attachment #1

	Chloride mg/L
1-day P ₉₉	260.5
4-day P ₉₉	225.1
30-day P ₉₉	204.56
Mean	193.44
Std	25.57
Sample size	18
Range	159 - 261

Sample Date	Copper µg/L	Sample Date	Zinc µg/L
03/17/2019	7	09/11/2012	66
03/20/2019	7	09/30/2013	62
03/23/2019	7	10/09/2013	57
03/26/2019	7	10/28/2013	57
03/29/2019	7	10/29/2013	68
04/01/2019	4	11/04/2013	58
04/05/2019	5	11/06/2013	56
04/08/2019	6	11/11/2013	62
04/11/2019	5	11/13/2013	73
04/14/2019	7	11/15/2013	64
04/17/2019	13	11/18/2013	85
		03/25/2019	77
1-day P ₉₉	13.9	1-day P ₉₉	89.2
4-day P ₉₉	10.0	4-day P ₉₉	76.6

The following table presents the average concentrations and loadings at Outfall 001 from December 2014 to April 2019 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

	Average Measurement
BOD ₅	4.4 mg/L*
TSS	4.1 mg/L
pH field	7.38 s.u.
Phosphorus	3.01 mg/L
Ammonia Nitrogen	0.42 mg/L
Nitrite +Nitrate	10 mg/L
Kjeldahl Nitrogen	2.37 mg/L
Fecal Coliform	420 #/100 mL
Chloride	193 mg/L
Total Dissolved Solids	580 mg/L

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

In general, permit limits for toxic substances are recommended whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)

if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d)

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e).

As a rule of thumb, if the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is the case for Baldwin Wastewater Treatment Facility and the limits are set using the 1-Q₁₀ method.

The following tables list the water quality-based effluent limitations for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Attachment #1

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 0 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)).

SUBSTANCE	REF. HARD.* mg/L	ATC	MEAN BACK- GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Arsenic		340		339.8	68.0	<1		
Cadmium	217	25.0		25.0	5.0	<3		
Chromium	217	3398		3398.0	680	<6		
Copper	217	32.2		32.2			13.9	13
Lead	217	226		225.8	45.2	<1		
Nickel	217	903		902.9	181	<8		
Zinc	217	237		236.8			89.2	85
Chloride (mg/L)		757		757.0			260.5	261

* * Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q₁₀ flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 0 cfs (¼ of the 7-Q₁₀)

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Arsenic		152.2		152	30.4	<1	
Cadmium	175	3.82		3.82	0.8	<3	
Chromium	217	248.97		249	49.8	<6	
Copper	217	20.07		20.1			10
Lead	217	59.15		59.2	11.8	<1	
Nickel	217	100.44		100	20.1	<8	
Zinc	217	236.82		237			76.6
Chloride (mg/L)		395		395			225

Monthly Average Limits based on Wildlife Criteria (WC)

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 0 cfs (¼ of the Harmonic Mean)

SUBSTANCE	HTC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370		370	74.0	<3
Chromium (+3)	3818000		3818000	763600	<6
Lead	140		140	28.0	<1
Nickel	43000		43000	8600	<8

Attachment #1

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 0 cfs (¼ of the Harmonic Mean)

SUBSTANCE	HCC	MEAN BACK- GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3		13.3	2.66	<1

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8) requires the evaluation of the cumulative cancer risk. Because effluent data is available for only one substance for which Human Cancer Criteria exists, and it was not detected in the effluent, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations: Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are not needed for toxic substances.

Chloride – Considering available effluent data from the current permit term (December 2014 to April 2019), the 1-day P₉₉ chloride concentration is 261 mg/L, and the 4-day P₉₉ of effluent data is 225 mg/L.

These effluent concentrations are below the calculated WQBELs for chloride, therefore no effluent limits are needed. Chloride monitoring is recommended to continue.

Mercury – The permit application did not require monitoring for mercury because the Baldwin Wastewater Treatment Facility is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, “there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5).” A review of the past five years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge from 2015 to 2017 was 0.37 mg/kg, with a maximum reported concentration of 0.49 mg/kg. Therefore, no mercury monitoring is recommended at Outfall 001.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. The current permit has daily maximum, weekly average and monthly average limits. These limits are re-evaluated at this time due to the following changes:

- Updates to subchapter IV of ch. NR 106, Wis. Adm. Code allow limits based on available dilution instead of limits set to twice the acute criteria.
- The maximum expected effluent pH has changed
- Updates to s. NR 106.07(3), Wis. Adm. Code require weekly and monthly average limits for municipal treatment plants.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

Daily maximum limitations are based on acute toxicity criteria, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - \text{pH})})] + [B \div (1 + 10^{(\text{pH} - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Limited Forage Fishery, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 1095 sample results were reported from December 2014 to April 2019. The maximum reported value was 7.80 s.u. (Standard pH Units). The effluent pH was 7.70 s.u. or less 99% of the time. The 1-day P₉₉, calculated in accordance with s. NR 106.05(5), is 7.65 s.u. And the mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.64 s.u. Therefore, a value of 7.65 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.65 s.u. into the equation above yields an ATC = 15.7 mg/L and a computed daily maximum limit of 15.7 mg/L using 1-Q₁₀ flow is zero cfs

Potential changes to daily maximum Ammonia Nitrogen effluent limitations

Updates to subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) outline the option for the Department to implement use of the 1-Q₁₀ receiving water low flow to calculate daily maximum ammonia nitrogen limits if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits would apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q₁₀ (estimated as 80 % of 7-Q₁₀) and the 2×ATC approach are shown below.

	Ammonia Nitrogen Limit mg/L
2×ATC	31.4
1-Q ₁₀	15.7

The 1-Q₁₀ method yields the most stringent limits for the Baldwin Wastewater Treatment Facility and results in a decrease from the current daily maximum permit limit.

Weekly Average & Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

The calculations from the 2008 WQBEL memo are shown in attachment #2. These calculations are still applicable because there have been no changes in the effluent and receiving water flow rates.

Attachment #1

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from December 2014 to April 2019, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Baldwin Wastewater Treatment Facility permit for the respective month ranges. That need is determined by calculating 99th upper percentile (or P₉₉) values for ammonia during each of the month ranges and comparing the daily maximum values to the daily maximum limit. Based on this comparison, ammonia limits would not be required.

Ammonia Nitrogen mg/L	October	November-April	May-September
1-day P ₉₉	1.7	3.0	4.2
4-day P ₉₉	0.9	1.7	2.3
30-day P ₉₉	0.43	0.74	1.06
Mean*	0.23	0.35	0.55
Std	0.37	0.68	0.93
Sample size	16	117	80
Range	0.0359 - 1.24	0.0143 - 3.89	0.023 - 4.26

*Values lower than the level of detection were substituted with a zero

Where there are existing ammonia nitrogen limits in the permit, the limits are recommended to be retained regardless of reasonable potential, consistent with s. NR 106.33(1), Wis. Adm. Code:

(b) If a permittee is subject to an ammonia limitation in an existing permit, the limitation shall be included in any reissued permit. Ammonia limitations shall be included in the permit if the permitted facility will be providing treatment for ammonia discharges.

Conclusions and Recommendations:

In summary, after rounding to two significant figures, the following ammonia nitrogen limitations are recommended. No mass limitations are recommended in accordance with s. NR 106.32(5).

	Daily Maximum mg/L	Weekly Average mg/L	Monthly Average mg/L
October			10
November-April	16	26	10
May-September		5.6	2.2

Additional limits to meet the expression of limits requirements in s. NR 106.07 are addressed in the expression of limits section of this memo.

PART 4 –PHOSPHORUS

Technology Based Phosphorus Limit

Wisconsin Administrative Code, ch. NR 217, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Attachment #1

Because the Baldwin Wastewater Treatment Facility does not currently have an existing technology-based limit, the need for this limit in the reissued permit is evaluated. The data demonstrates that the annual monthly average phosphorus loading is greater than 150 lbs/month, which is the threshold for municipalities in accordance to s. NR 217.04(1)(a)1, and therefore a technology-based limit is recommended.

Sample Date	Monthly Avg. mg/L	Total Flow MG/month	Total Phosphorus lb./mo.
Jan 2018	3.87	8.91	287.5
Feb 2018	4.18	7.91	275.4
Mar 2018	3.36	11.71	328.0
April 2018	1.76	15.07	221.2
May 2018	1.71	11.43	163.4
June 2018	0.78	10.34	66.9
July 2018	1.55	9.45	121.8
Aug 2018	1.64	10.13	138.4
Sept 2018	0.47	12.64	49.3
Oct 2018	2.06	15.20	261.5
Nov 2018	3.19	12.21	324.6
Dec 2018	3.24	11.02	297.4
Average =			211.3

Total P (lbs/month) = Monthly average (mg/L) × total flow (MGD) × 8.34 (lbs/gallon)

Where total flow is the sum of the actual (not design) flow (in MGD) for that month

In addition, the need for a WQBEL for phosphorus must be considered.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to ch. NR 102 (s. NR 102.06), which establish phosphorus standards for surface waters. Revisions to ch. NR 217 (s. NR 217, Subchapter III) establish procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102.

Section NR 102.06(3)(a) specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.075 mg/L applies for Baldwin Creek

The conservation of mass equation is described in s. NR 217.13 (2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs):

$$\text{Limitation} = [(WQC)(Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)] / Q_e$$

Where:

WQC = 0.075 mg/L for Baldwin Creek.

Qs = 100% of the 7-Q₂ of 0 cfs

Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code

Attachment #1

Q_e = effluent flow rate = 0.292 MGD = 0.452 cfs

f = the fraction of effluent withdrawn from the receiving water = 0

Since the receiving water flow is equal to zero, the effluent limit is set equal to criteria.

Effluent Data

The following table summarizes effluent total phosphorus monitoring data from December 2014 to April 2019.

	Phosphorus mg/L
1-day P_{99}	7.0
4-day P_{99}	4.7
30-day P_{99}	3.58
Mean	3.01
Std	1.23
Sample size	214
Range	0.053 - 8.12

Reasonable Potential Determination

Since the 30-day P_{99} of reported effluent total phosphorus data is greater than the calculated WQBEL, **the discharge has reasonable potential to cause or contribute to an exceedance of the water quality criterion. Therefore, a WQBEL is recommended.**

Limit Expression

Because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.075 mg/L may be expressed as a six-month average. If a concentration limitation expressed as a six-month average is included in the permit, a monthly average concentration limitation of 0.225 mg/L, equal to three times the WQBEL calculated under s. NR 217.13 shall also be included in the permit. The six-month average should be averaged during the months of May – October and November – April.

Interim Limit

An interim limit is required per s. NR 217.17 when a compliance schedule is needed in the permit to meet the WQBEL. The interim limit should reflect a concentration that the facility is able to meet without investing in additional “temporary” treatment, but also should prevent backsliding from current conditions. Therefore, **it is recommended that the interim limit be set equal to 4.7 mg/L for permit reissuance along with requirements for optimization of phosphorus removal.** This value reflects the 4-day P_{99} concentration of 4.7 mg/L from the current permit term. This value is recommended instead of the 30-day P_{99} concentration of 3.58 mg/L to allow operational flexibility when the facility begins to initiate phosphorus treatment optimization activities, which often consist of trial and error.

PART 5 –THERMAL

New surface water quality standards for temperature took effect on October 1, 2010. These new regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code.

Attachment #1

Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

In accordance with s. NR 106.53(2)(b), the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from December 2014 to April 2019.

The table below summarizes the maximum temperatures reported during monitoring from January to December of 2017.

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)
JAN	52	52	54	78
FEB	52	52	54	79
MAR	49	54	57	80
APR	53	56	63	81
MAY	58	60	70	84
JUN	64	64	77	85
JUL	68	70	81	86
AUG	71	72	79	86
SEP	70	72	73	85
OCT	69	70	63	83
NOV	56	58	54	80
DEC	54	58	54	79

Reasonable Potential

Permit limits for temperature are recommended based on the procedures in s. NR 106.56.

- An acute limit for temperature is recommended for each month in which the representative daily maximum effluent temperature for that month exceeds the acute WQBEL. The representative daily maximum effluent temperature is the greater of the following:
 - (a) The highest recorded representative daily maximum effluent temperature
 - (b) The projected 99th percentile of all representative daily maximum effluent temperatures
- A sub-lethal limitation for temperature is recommended for each month in which the representative weekly average effluent temperature for that month exceeds the weekly average WQBEL. The representative weekly average effluent temperature is the greater of the following:
 - (a) The highest weekly average effluent temperature for the month.
 - (b) The projected 99th percentile of all representative weekly average effluent temperatures for the month

Comparing the representative highest effluent temperature to the calculated effluent limits determines the reasonable potential of exceeding the effluent limits. The months in which limitations are recommended are highlighted. Based on this analysis, weekly average temperature maximum limits are necessary for the months of October and November.

The following general options are available for a facility to explore potential relief from the temperature limits:

- Effluent monitoring data: Verification or additional effluent monitoring (flow and/or temperature) may be appropriate if there were questions on the representativeness of the current effluent data.
- Monthly low receiving water flows: Contract with USGS to generate monthly low flow estimates for the receiving water to be used in place of the annual low flow.
- Mixing zone studies: A demonstration of rapid and complete mixing may allow for the use of a mixing zone other than the default 25%.
- Dissipative cooling demonstration: Effluent limitations based on sub-lethal criteria may be adjusted based on the potential for heat dissipation from municipal treatment plants (s. NR 106.59(4))
- Collection of site-specific ambient temperature: default background temperatures for streams in Wisconsin, so actual data from the direct receiving water may provide for relaxed thermal limits but only if the site-specific temperatures are lower than the small stream defaults used in the above tables
- A variance to the water quality standard: This is typically considered to be the least preferable and most complex option as it requires the evaluation of the other alternatives.

These options are explained in additional detail in the August 15, 2013 Department *Guidance for Implementation of Wisconsin's Thermal Water Quality Standards*
<http://dnr.wi.gov/topic/surfacewater/documents/ThermalGuidance2edition8152013.pdf>

The Village of Baldwin has submitted a request for consideration of dissipative cooling. This request states that there have been no substantial changes in the operation of, or thermal loadings to, the treatment facility since the 2014 dissipative cooling determination. The department has reviewed that request and associated data and believes that the effluent does not have a reasonable potential to cause or contribute to an exceedance of the sub-lethal criterion outside of a small area of mixing and cooling. Therefore, a temperature limit is not recommended at this time. Effluent monitoring is recommended for the 4th year of the permit term.

Future WPDES Permit Reissuance

Dissipative cooling requests must be re-evaluated every permit reissuance. The permittee is responsible to submit an updated DC request prior to permit reissuance. Such a request must either include:

- a) A statement by the permittee that there have been no substantial changes in operation of, or thermal loadings to, the treatment facility and the receiving water; or
- b) New information demonstrating DC to supplement the information used in the previous DC determination. If significant changes in operation or thermal loads have occurred, additional DC data must be submitted to the Department.

PART 6 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. The following evaluation is based on procedures in the Department's WET Program Guidance Document (revision #11, dated November 1, 2016).

The WET Checklist was not used to evaluate this discharge. Instead, guidance in Chapter 1.11 of the WET Guidance (WET Testing of Minor Municipal Discharges) was consulted. This is a minor municipal (< 1.0 MGD) discharge comprised solely of domestic wastewater, with no WET failures and no toxic compounds detected at levels of concern. Because there is a very low risk of toxicity, no WET testing is recommended at this time.

PART 7 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin's water quality-based effluent limits with 40 CFR 122.45(d), which requires WPDES permits contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

The Baldwin Wastewater Treatment Facility is a municipal treatment facility and is therefore subject to weekly average and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, and pH, among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for calculation:

The methods for calculating limitations for continuous discharges subject to ch. NR 210 to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), and are as follows:

1. Whenever a daily maximum limitation is determined necessary to protect water quality, a weekly and monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.
2. Whenever a weekly average limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
3. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

Attachment #1

$$\text{Weekly Average Limitation} = (\text{Monthly Average Limitation} \times \text{MF})$$

Where:

MF= Multiplication factor as defined in Table 1

CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m)

n= the number of samples per month required in the permit

s. NR 106.07 (3) (e) 4. Table 1 — Multiplication Factor (for CV = 0.6)

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.6	1.00	1.31	1.51	1.64	1.95	2.12	2.23	2.30	2.36	2.43

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

Summary of Additional Limitations:

In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR 205.065(7) Expression of Limits.

Parameter	Daily Maximum	Weekly Average	Monthly Average	Weekly Geometric Mean	Monthly Geometric Mean	Multiplication Factor (CV)	Assumed Monitoring Frequency (n)
Fecal Coliform				780#/100 mL geometric mean	400#/100 mL geometric mean	1.95 (0.6)	2/Week (8)
Ammonia Nitrogen October		16 mg/L	10 mg/L			1.64 (0.6)	Weekly (4)
Ammonia Nitrogen November – April	16 mg/L	16 mg/L					

For May – September the weekly and monthly average ammonia nitrogen limits meet the expression of limits requirements and additional limits are not needed for those months.

Ammonia Nitrogen WQBEL Calculation from February 26, 2008 Memo**AMMONIA (as N) LIMITS**

Effluent Flow (mgd):	0.392
Effluent Flow (cfs):	0.607
<hr/>	
Effluent pH data:	
Begin Date	01-Oct-04
End Date	30-Nov-07
# of Samples	1641
Maximum	7.8
Average	7.21
Standard Deviation	0.159
Estimated 99th Percentile	7.58
Max. Effluent pH (s.u.):	7.60

BACKGROUND INFORMATION

	<i>May-Sep</i>	<i>Oct-Apr</i>
7Q10 (cfs)	0	0
7Q2 (cfs)	0	0
Ammonia (mg/L) (1)	0	0
Temperature (deg C) (2)	23	10
pH (std. units) (3)	8.21	7.97
% of river flow used:	100	25
Reference weekly flow:	0	0
Reference monthly flow:	0	0

CRITERIA (in mg/L)

Acute (@ effl. pH):	17.03	17.03
4-day Chronic (@ backgrd. pH):		
early life stages present	5.60	8.06
early life stages absent	7.69	25.60
30-day Chronic (@ backgrd. pH)		
early life stages present	2.24	3.22
early life stages absent	3.08	10.24

EFFLUENT LIMITS (in mg/L)

Daily maximum	34	34
Weekly average		
early life stages present	5.6	
early life stages absent		26
Monthly average		
early life stages present	2.2	
early life stages absent		10

(1) Default Data

(2) Default Data

(3) Default Data based on effluent hardness

Attachment #3

Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

Facility: Baldwin WWTF **7-Q₁₀:** 0.00 cfs **Temp Dates** **Flow Dates**
Outfall(s): 001 **Dilution:** 25% **Start:** 01/03/17 12/01/14
Date Prepared: 06/14/2019 **f:** 0 **End:** 12/30/17 04/30/19
Design Flow (Q_e): 0.292 MGD **Stream type:** Limited forage fish community
Storm Sewer Dist. 0 ft **Qs:Q_e ratio:** 0.0 :1
Calculation Needed? YES

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs) (cfs)	Representative Highest Effluent Flow Rate (Q _e)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Q _{esl}) (MGD)	Daily Maximum Flow Rate (Q _{ea}) (MGD)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)		(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	37	54	78	0.00	0.433	0.490	0	52	52	54	78
FEB	39	54	79	0.00	0.540	0.839	0	52	52	54	79
MAR	43	57	80	0.00	0.698	1.357	0	49	54	57	80
APR	50	63	81	0.00	0.851	1.625	0	53	56	63	81
MAY	59	70	84	0.00	0.930	1.469	0	58	60	70	84
JUN	64	77	85	0.00	0.501	0.759	0	64	64	77	85
JUL	69	81	86	0.00	0.711	1.436	0	68	70	81	86
AUG	68	79	86	0.00	0.604	0.920	0	71	72	79	86
SEP	63	73	85	0.00	0.604	0.972	0	70	72	73	85
OCT	55	63	83	0.00	0.654	0.970	0	69	70	63	83
NOV	46	54	80	0.00	0.603	0.740	0	56	58	54	80
DEC	40	54	79	0.00	0.643	1.098	0	54	58	54	79

